Recent Introductions for Biological Control in Hawaii-XIII

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INTRODUCTION

This paper includes a list of new introductions and additional releases of beneficial organisms for biological control in Hawaii (Table I) made since the last published listing (Davis and Krauss, 1966) and gives a few notes on the status of pests and recently introduced organisms for the control of snail, weed and insect pests.

SNAIL PEST CONTROL

Achatina fulica Bowdich (giant African snail)

Eradication efforts on the previously snail-free islands of Kauai and Hawaii continued. On the former, an incipient infestation was discovered at Wahiawa Gulch on 24 April 1967 and is being treated with commercial metaldehyde pellets. On the latter island, eradication of the giant African snail appears to have been successful at Hakalau, no living snails having been found in over 3 years. However, in Kona, *Achatina* has extended its range and an aerial application consisting of metaldehyde, lime, volcanic cinders, and cement was made on the 11th of October 1967 followed by ground applications in an effort to eliminate the pestiferous giant African snail.

The introduced carnivorus snail, *Gonaxis quadrilateralis* (Preston), appeared in unusually large numbers on Makiki Round Top Drive on 30 October 1967 greatly outnumbering its prey, *A. fulica.* Of 200 *G. quadrilateralis* collected, only 1 was attacked by *Geoplana septemlineata* Hyman, an important flatworm predator of the giant African snail. A reduction in giant African snail populations in this locality was first observed during the rainy season of 1964 and 1965.

Lymnaea ollula Gould (liverfluke snail)

The first recovery of *Sepedon sauteri* Hendel, an aquatic sciomyzid snail predator introduced from Fukuoka, Japan was made at Waianae Valley on 29 August 1967. *S. sauteri* was first released in this locality on 29 March 1967.

WEED PEST CONTROL

Lantana camara var. **aculeata** (L.) Moldenke (lantana)

Introduced lantana defoliators, namely, *Hypena strigata* (Fabricius),

TABLE 1. *New introductions and additional releases for biological control in Hawaii*-XIII 1967

(All introductions by Entomology Branch, Hawaii Department of Agriculture, except as indicated)

Pest needing control	*Organism introduced*	*Source*	*Collector*	*Date rel'd* (1967)	*Number*	*Release point*
WEED PESTS						
Tribulus cistoides L. (puncture-vine)	**Microlarinus lareynii* (Jacquelin du Val) (Coleoptera: Curculionidae)	Riverside, California	R. Goeden	Jul 31	1,030 adults	Sandy Beach, Oahu Makapuu, Oahu
INSECT PESTS						
Schistocerca vaga (Scudder) (vagrant grasshopper)	*Blaesoxipha lineata* Fallén (Diptera: Sarcophagidae)	Moorestown, New Jersey (origin-France)	L. W. Coles	Jan 6	14	Sand Island, Oahu
Nezara viridula (Linnaeus) (southern green stink bug)	*Trissolcus nakagawai* Watanabe (Hymenoptera: Scelionidae)	Kochi, Japan	K. Kiritani Prefectural Inst. of Agr. & For. Sci. Shikoku, Japan	Aug 22	500	Kahului, Maui
Ceroplastes spp. (wax scales) and *Saissetia* spp. (soft scales)	*Coccidoxenus mexicanus* (Girault) (Hymenoptera: Encyrtidae)	Trinidad, West Indies	F. Bennett	Jul 17	25	Kahului, Maui
Pseudococcus obscurus Essig (obscure mealybug)	**Cryptolaemus montrouzieri* Mulsant (Coleoptera: Coccinellidae)	California	Rin Con Insectary, Ventura, Calif.	June 8	10,000	Kahului, Maui
Sphenophorus venatus vestitus Chittenden	**Patasson calendrae* (Gahan) (Hymenoptera: Mymaridae)	Columbia, Missouri	C. J. Davis Harry Nakao	Sept 20	63	Kahua Ranch, Kohala

*Previously introduced.

Syngamia haemorrhoidalis Guenée and *Catabena esula* (Druce) were generally at low population levels on most islands during 1967. This resulted in considerable regrowth in some localities. However, the introduced beetles, *Plagiohammus spinipennis* Thomson, *Octotoma scabripennis* Guérin-Méneville, and *Uroplata girardi* Pic continued to increase and spread and are expected to reach their control potential within 3 to 5 years.

Hypericum perforatum L. (Klamath weed)

A significant development in the Klamath weed infestation on Mt. Hualalai, Hawaii is the death of numerous plants at the release point for the gall midge, *Zeuxidiplosis giardi* (Kieffer), and the chrysomelid beetle, *Chrysolina quadrigemina* (Suffrian). Limited observations indicate that *Z. giardi* is active throughout the year, resulting in heavy gall density per plant. This may be a contributing factor in the demise of Klamath weeds at 6700 ft elevation on Mt. Hualalai. *C. quadrigemina* appears to be gradually increasing but has not reached damaging population levels.

Melastoma malabathricum L. (Indian rhododendron)

The introduced arctiid, *Selca brunella* (Hampson), reached damaging levels in the Kilohana region of Kauai where approximately 8000 acres of the noxious weed, *M. malabathricum*, occur. The first release of *S. brunella* was made at Huleia on 15 February 1966.

INSECT PEST CONTROL

Nezara viridula (Linnaeus) (southern green stink bug)

Through the cooperation of Dr. K. Kiritani of the Prefectural Institute of Agriculture and Forest Science, Shikoku, Japan a shipment of the *Nezara* egg parasite, *Trissolcus nakagawai* Watanabe, was received on 21 June 1967. *T. nakagawai* was successfully cultured at the insectary facilities at Kahului, Maui and the first release of 500 egg parasites was made at Kahului on 22 August 1967. No recoveries have been made to date.

Sphenophorus venatus vestitus Chittenden (hunting billbug)

Although the hunting billbug has seriously damaged rhizomes of kikuyugrass, *Pennisetum clandestinum*, on Hawaii, its full damaging potential has not been attained to date and undoubtedly will not be known until infested pasture localities have been subjected to an extended drought.

The egg parasite, *Patasson calendrae* (Gahan) was reintroduced from Missouri and, after successful culturing, was initially liberated at Kahua Ranch on 20 September 1967. Cultures of this mymarid egg parasite were transferred to Maui and Hawaii facilities and a total of 7,958 parasites was released on Hawaii and Maui up to the end of the year.

Ceroplastes cirripediformis Comstock (barnacle scale)

Many linear feet of passion fruit vines were killed by the barnacle scale in a commercial orchard on Maui during the latter part of 1966 and early 1967. Field collected material was negative for parasitism,

suggesting that bio-control agents were either not present on the island or at extremely low levels. The following parasites were reared from *C. cirripediformis* on Oahu and released on Maui during 1967: *Aneristis ceroplastae* Howard, 2,822; *Scutellista cyanea* Motschulsky, 170; *Anysis alcocki* (Ashmead), 97; *Microterys kotinskyi* Fullaway, 12; and *Tetrastichus* sp. (?) *ceroplastae* (Girault), 4,250.

MISCELLANEOUS

The following introductions were inadvertently omitted in previous notes or papers: *Metaphycus luteolus* Timberlake, 1964; *Ecphylus* sp., 1965; *Bracon* sp. n., 1965; *Agathis* sp. n., 1965; *Onthophagus sagittarius* (F.), 1965.

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Davis, C. J. 1967. Progress in the biological control of the southern green stink bug, *Nezara viridula* variety *smaragdula* (Fabricius) in Hawaii (Heteroptera: Pentatomidae) Mushi **39**: 9–16.

Mead, A. R. 1963. A Flatworm Predator of the Giant African Snail *Achatina fulica* in Hawaii. Malacologia **1**(2): 305–311.

CHECKLIST OF INTRODUCTIONS

1. *Achrysocharis* sp. **18**(1): 129[1]
2. *Acinia picturata* (Snow) **17**(2): 245 (=*A. fucata*)
3. *Adalia bipunctata* **15**(1): 129; **18**(2): 248
4. *Adalia testudinea* Wollaston (1962) (*Not recorded in Proceedings*)
5. *Adonia variegata* (Goeze) **18**(2): 248
6. *Aenasius advena* Compere **17**(1): 64
7. *Aerenicopsis championi* Bates **16**(1): 162
8. *Agathis* sp. n. (1967) (*Publication pending*)
9. *Alesia striata* Fabricius **16**(3): 358
10. *Allograpta* sp. **15**(2): 369
11. *Anysis alcocki* (Ashmead) **19**(1): 88
12. *Apanteles agonoxenae* Fullaway **16**(2): 313
13. *Apanteles expulsus* (Turner) **15**(1): 128
14. *Apanteles militaris* (Walsh) **17**(3): 391

[1]All volume references are to the Proceedings of The Hawaiian Entomological Society unless otherwise noted.

15. *Apanteles rubecula* Marshall (1967) (*Publication pending*)
16. *Apanteles ruficrus* Haliday **15**(1): 128
17. *Apanteles* sp. **15**(3): 635
18. *Aphidius smithi* Sharma & Rao **17**(3): 391
19. *Aphytis holoxanthus* DeBach **18**(3): 394
20. *Aphytis* spp. **15**(3): 635
21. *Apion antiquum* Gyllenhal **16**(3): 358
22. *Apion neofallax* (Warner) **18**(2): 246
23. *Apion scutellare* Kirby **18**(1): 128
24. *Apion* sp. **17**(1): 63
25. *Apion violaceum* var. *harcyniae* (Hubenthal) **18**(2): 246
26. *Apotoforma* sp. **19**(1): 88
27. *Archaioneda tricolor fijiensis* Crotch **17**(3): 391
28. *Archlagocheirus funestus* Thomson **18**(2): 209
29. *Ateuchus lecontei* Harold **18**(3): 395
30. *Atrichomelina pubera* (Loew) **18**(1): 127
31. *Azya trinitatis* Marshall **15**(3): 635
32. *Baccha* sp. **15**(2): 370
33. *Bembecia marginata* (Harris) **18**(3): 394
34. *Blaesoxipha lineata* Fallén (*In press*)
35. *Blepharomastix acutangulalis* (Snellen) **15**(3): 635
36. *Bocchoris adipalis* Zeller **19**(2): 202
37. *Bocchoris fatualis* (Lederer) **17**(1): 63
38. *Brachymeria agonoxenae* Fullaway **16**(2): 313
39. *Brachymeria robustella* (Wolcott) **15**(1): 128
40. *Brachymeria* sp. **15**(3): 636
41. *Bracon cajani* Muesebeck **16**(3): 358
42. *Bracon fletcheri* Silvestri **14**(2): 329
43. *Bracon gelechiae* Ashmead **16**(1): 163
44. *Bracon sp.* **16**(2): 313
45. *Bracon* sp. n. (1967) (*Publication pending*)
46. *Bracon* spp. **15**(2): 369 (=*Microbracon*)
47. *Bracon xanthonotus* Ashmead **15**(1): 129
48. *Bruchus atronotatus* Pic **17**(3): 390
49. *Bubulcus ibis* Linnaeus **18**(1): 129
50. *Cactoblastis cactorum* (Berg) **14**(2): 327
51. *Calosoma peregrinator* Guérin **15**(3): 636
52. *Calosoma* sp. **16**(3): 358
53. *Campoplex* (=*Omorgus*) *phthorimaeae* (Cushman) **14**(2): 327
54. *Campsomeris annulata* (Fabricius) **16**(1): 163
55. *Campsomeris manokwariensis* (Cameron) **16**(1): 163
56. *Canthon chevrolati* Harold **16**(1): 162
57. *Canthon pilularis* (Linnaeus) **18**(3): 395
58. *Canthon viridis* (Palisot de Beauvois) **16**(1): 162

59. *Catabena esula* Druce **16**(1): 162
60. *Ceratomegilla vittigera* (Mannerheim) **15**(1): 129
61. *Chaetospila frater* (Girault) **19**(1): 88
62. *Chelonus narayani* Rao **16**(3): 358
63. *Chilocorus bipustulatus* (Linnaeus) **15**(1): 129
64. *Chilocorus nigritus* (Fabricius) **17**(1): 65
65. *Chrysocharis majoriani* Girault **18**(1): 129
66. *Chrysolina quadrigemina* (Suffrian) **19**(2): 134, 202
67. *Coccidoxenus mexicanus* (Girault) (1967) (*Publication pending*)
68. *Coccinella californica* Mannerheim **18**(3): 396
69. *Coelophora atrolineata* Fairmaire **17**(3): 391
70. *Coelophora inaequalis* (Fabricius) **17**(1): 64
71. *Coleomegilla cubensis* Casey **15**(1): 128
72. *Crasimorpha infuscata* Hodges sp. n. [PROC. ENT. SOC. WASH. Vol. 65(4): 303–305], **18**(1): 128
73. *Cycloneda limbifer* Casey **15**(1): 128
74. *Cycloneda sanguinea* (Linnaeus) **16**(1): 164
75. *Cyrtorhinus lividipennis* Reuter **15**(1): 128
76. *Dactylopius confusus* (Cockerell) **14**(2): 327
77. *Damaster blaptoides blaptoides* Kollar **17**(1): 63
78. *Damaster blaptoides rugipennis* Motchulsky **17**(1): 63
79. *Dendrosoter enervatus* Marsh sp. n. **19**(1): 88
80. *Diastema tigris* Guenée **15**(3): 635
81. *Dictya abnormis* Steyskal **17**(2): 245
82. *Dirhinus giffardii* Silvestri **14**(2): 329
83. *Ecphylus* sp. **19**(2)
84. *Edentulina affinis* Boettger **16**(3): 357
85. *Egius platycephalus* Mulsant **15**(1): 129
86. *Eiphosoma* sp. **15**(2): 369
87. *Encyrtidae* sp. **17**(1): 64
88. *Episimus* sp. **16**(1): 163
89. *Eretmocerus haldemani* Howard **15**(1): 129
90. *Euglandina rosea* (Férussac) **16**(1): 163
91. *Geotrupes* sp. **16**(3): 358
92. *Gonaxis kibweziensis* (Smith) **15**(1): 130; **16**(1): 163
93. *Gonaxis quadrilateralis* (Preston) **16**(3): 356
94. *Gonaxis vulcani* (Thiele) **16**(2): 313
95. *Gulella bicolor* Hutton **16**(3): 357
96. *Gulella wahlbergi* (Krauss) **16**(2): 313
97. *Harmonia arcuata* (Fabricius) **16**(2): 313
98. *Heptagenia rubroventris* Traver **18**(1): 129
99. *Hippodamia convergens* Guérin-Meneville **15**(1): 129; **18**(3): 396
100. *Hippodamia quinquesignata punctulata* LeConte **15**(1): 129
101. *Hister abbreviatus* Fabricius **18**(3): 396

102. *Hister coenosus* Erichson **15**(1): 128; **18**(3): 396
103. *Hister confinis* Erichson **15**(1): 128
104. *Hister javanicus* Paykull **17**(1): 65
105. *Hister nomas* Erichson **19**(2): 127
106. *Hololepta* spp. **15**(3): 637
107. *Horogenes insularis* (Cresson) **15**(3): 636
108. *Horogenes* sp. **15**(3): 636
109. *Hypena strigata* Fabricius **16**(3): 358
110. *Hyperaspis languida* (Mulsant) (=albicolis Gorham) **15**(3): 637
111. *Hyperaspis trilineata* Mulsant **18**(3): 396
112. *Iron lagunitas* Traver **18**(1): 129
113. *Lagocheirus funestus* Thomson **15**(1): 1—8 (Name suppressed by *Archlagocheirus* #28)
114. *Lamprophorus tenebrosus* (Walker) **16**(3): 357
115. *Leionota* sp. **15**(2): 370
116. *Lioscymnus diversipes* Champion **15**(2): 370
117. *Liothrips urichi* Karny **15**(2): 369
118. *Litomastix* sp. **17**(1): 65
119. *Lysiphlebus* sp. **15**(2): 369
120. *Macrocentrus ancylivorus* Rohwer **15**(3): 637
121. *Macrotrachelia thripiformis* Champion **19**(2): 203
122. *Melitara bollii* (Zeller) **14**(2): 327
123. *Melitara prodenialis* Walker **14**(2): 327
124. *Metaphycus luteolus* Timberlake (1964) (*Unpublished record*)
125. *Microbracon* spp. **15**(2): 369
126. *Microlarinus lareynii* (Jacquelin du Val) **18**(2): 247
127. *Microlarinus lypriformis* (Wollaston) **18**(3): 392
128. *Moneilema armata* LeConte **15**(1): 130
129. *Moneilema crassa* LeConte **14**(2): 327
130. *Montandoniola moraguesi* (Puton) **19**(1): 88; **19**(2): 206
131. *Muscidifurax raptor* Girault & Sanders (Puerto Rican strain) **19**(2): 203
132. *Muscidifurax raptor* Girault & Sanders (Chile) (1967)
133. *Muscidifurax raptor* Girault and Sanders (California) (1967) (*Publication pending*)
134. *Octotoma scabripennis* Guérin-Méneville **16**(1): 164; **18**(3): 392
135. *Octotoma plicatula* (Fabricius) **15**(3): 635
136. *Oleacina oleacea straminea* (Deshayes) **16**(2): 313
137. *Oleacina* sp. **16**(2): 313
138. *Oniticellus cinctus* (Fabricius) **19**(3): 321
139. *Oniticellus militaris* Lap. **19**(3): 328
140. *Onthophagus oklahomensis* Brown **18**(3): 395
141. *Onthophagus* sp. **18**(3): 396
142. *Onthophagus tuberculifrons* Harold **18**(3): 396

143. *Ooencyrtus submetallicus* (Howard) **18**(2): 247
144. *Ooencyrtus trinidadensis* Crawford **18**(2): 247
145. *Opius anastrephae* (Viereck) **15**(1): 127
146. *Opius angaleti* Fullaway **15**(1): 127
147. *Opius cereus* Gahan **15**(1): 127
148. *Opius compensans* (Silvestri) **15**(1): 127
149. *Opius deeralensis* Fullaway **14**(2): 329
150. *Opius fijiensis* Fullaway **14**(2): 329
151. *Opius formosanus* Fullaway **14**(2): 329
152. *Opius incisi* Silvestri **14**(2): 328; **19**(1): 88
153. *Opius kraussii* Fullaway **14**(2): 328
154. *Opius longicaudatus* (Ashmead) **14**(2): 328
155. *Opius longicaudatus* var. *taiensis* Fullaway **17**(3): 358
156. *Opius makii* Sonan **15**(1): 127
157. *Opius oophilus* Fullaway **15**(1): 127
158. *Opius phaeostigma* Wilkinson **15**(1): 127
159. *Opius skinneri* Fullaway **14**(2): 329
160. *Opius* sp. Vol. 14(2): 329, **15**(1): 128
161. *Opius* sp. near. *oscindis* (Ashmead) **18**(1): 129
162. *Opius* spp. **14**(2): 329
163. *Opius persulcatus* (Silvestri) **14**(2): 328
164. *Opius vandenboschi* Fullaway **14**(3): 413
165. *Opius watersi* Fullaway **14**(2): 329
166. *Orius insidiosus* (Say) **15**(1): 128
167. *Orius tristicolor* (White) **18**(2): 248; Vol. 19(1): 88
168. *Pachylister caffer* Erichson **19**(2): 127
169. *Pachylister chinensis* Quenstedt **17**(1): 65
170. *Pachylister lutarius* Erichson **17**(1): 65
171. *Patasson calendrae* (Gahan) **18**(3): 395
172. *Pentilia insidiosa* Mulsant **15**(3): 635
173. *Perisierola emigrata* Rohwer **16**(2): 294
174. *Phanaeus daphnis* Harold **16**(1): 162
175. *Pherbellia grisescens* (Meigen) **18**(1): 127
176. *Phorocera erecta* Coquillett **15**(1): 129
177. *Pinotus carolinus* (Linnaeus) **16**(1): 162
178. *Plagiohammus spinipennis* Thomson **17**(3): 390; Vol. 18(2): 246
179. *Priophorus morio* Lepeletier (1966) (*Publication pending*)
180. *Ptychotrema* sp. **16**(2): 313
181. *Ptychotrema walikalense* Pilsbry **16**(2): 313
182. *Pyrophorus pellucens* Eschscholtz **15**(2): 370
183. *Santalus orientalis* Paykull **17**(1): 65
184. *Scaphinotus* sp. **16**(2): 314
185. *Scaphinotus striatopunctatus* (Chaudoir) **16**(2): 314
186. Scarabaeidae, undetermined **17**(1): 65

187. *Schreckensteinia festaliella* (Hübner) **18**(3): 394
188. *Sciomyza dorsata* Zetterstedt **17**(3): 390
189. *Scymnus* (s. str.) *levaillanti* Mulsant **18**(2): 248
190. *Scymnus roepkei* Fluiter **17**(1): 64
191. *Scymnus* sp. **17**(1): 64
192. *Scymnus* (*Pullus*) *subvillosus* (Goeze) **18**(2): 248
193. *Selca brunella* Hampson **19**(2): 205
194. *Sepedon macropus* Walker **17**(1): 63
195. *Sepedon praemiosa* Giglio-Tos **18**(1): 127
196. *Sepedon sauteri* Hendel **19**(3): 377
197. *Spalangia cameroni* Perkins (Jamaica strain) **19**(2): 203
198. *Spalangia cameroni* Perkins (Trinidad strain) **19**(2): 202
199. *Spalangia endius* Walker (Puerto Rican strain) **19**(2): 203
200. *Spalangia longepetiolata* Boucek (Kenya) (*Publication pending*)
201. *Spalangia nigra* Latreille (1967) (*Publication pending*)
202. *Sphegegaster* sp. (1967) (*Publication pending*)
203. *Stethorus picipes* Casey **15**(1): 129
204. *Strepsicrates smithiana* (Walsingham) **16**(2): 314
205. *Streptaxis contusus* (Férussac) **18**(1): 127
206. *Syngamia haemorrhoidalis* Guenée **16**(2): 314
207. *Synonyche grandis* Thunberg 17(1): 64
208. *Syntomosphyrum indicum* Silvestri **14**(2): 330; **15**(1): 127
209. *Tachinaephagus zealandicus* Ashmead (*Publication pending*)
210. *Tefflus carinatus* Klug **17**(2): 245
211. *Tefflus hacquardi* de Chaudoir **15**(1): 130
212. *Tefflus jamesoni* Bates **16**(2): 314
213. *Tefflus purpureipennis wituensis* Kolbe **16**(3): 357
214. *Tefflus tenuicollis* Fairmaire **16**(2): 314
215. *Tefflus zanzibaricus alluaudi* Sternberg **16**(3): 357
216. *Telenomus basalis* Wollaston **18**(2): 247 (Name suppressed by *Trissolcus basalis* #230)
217. *Teleonemia scrupulosa* Stål **15**(3): 635
218. *Teleonemia* sp. **15**(3): 635
219. *Teleonemia vanduzeei* Drake **15**(1): 129; **15**(3): 635; **18**(3): 394
220. *Tetraeuaresta obscuriventris* (Loew) **18**(1): 128
221. *Tetrastichus dacicida* Silvestri **14**(2): 330
222. *Tetrastichus* sp. **15**(2): 369
223. *Tetrastichus* sp. near. *sokolowskii* Kurjdmov **15**(3): 636
224. *Thermophilum hexastictum* Gerst **16**(3): 357
225. *Thyreocephalus albertisi* (Fauvel) **14**(2): 328
226. *Tiphia paralella* Smith **17**(1): 65
227. *Trichopoda pennipes* (Fabricius) **18**(3): 395
228. *Trichopoda pennipes* var. *pilipes* Fabricius **18**(2): 247
229. *Trichotaphe aenigmatica* Clarke **18**(1): 123

230. *Trissolcus basalis* Wollaston (see *Telenomus basalis*)
231. *Trissolcus mitsukurii* (Ashmead) (1966) **19**(3): 377
232. *Trissolcus nakagawai* Watanabe (1967) (*Publication pending*)
233. *Trox procerus* (Harold) **19**(3): 379
234. *Trybliographa daci* Weld **14**(2): 328
235. *Typhlodromus* sp. **15**(1): 129
236. *Tyto alba* Scopoli **18**(1): 129
237. *Uroplata girardi* Pic **18**(1): 128
238. *Verania crocea* (Mulsant) **17**(1): 64
239. *Verania* sp. **17**(1): 64
240. *Winthemia* sp. (*diversoides* Bar?) **19**(1): 15
241. *Xanthaciura connexionis* Benjamin **16**(1): 162
242. *Xenoencyrtus niger* Riek **18**(2): 248
243. *Zeuxidiplosis giardi* Kieffer **19**(2): 134